

Space Technologies

Submicron Optical Aerosol Spectrometer

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A light-scattering instrument capable of measuring in situ aerosol particle sizes from 0.02 to 100 microns in concentrations as low as 1 part per billion, under low-pressure conditions (as low as ~0.05 Torr) has been developed. The instrument illustrated in the first figure can provide continuous data monitoring and data collection to encompass the wide dynamic size range and concentration conditions needed in studies of planetary atmosphere models, as well as field experiments addressing Earth air-quality pollution standards. A fiber-coupled argon-ion laser system, which incorporates polarization ratio scattering measurements was used to determine the size distribution at particle sizes smaller than 0.1 micron. As particle concentration and size increases, data collection shifts to angular (diffraction-based) scattering for larger particle

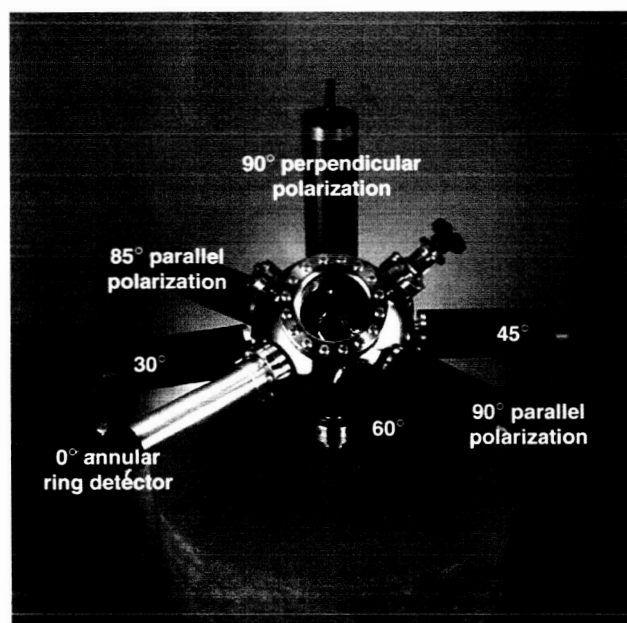


Fig. 1. Atmospheric aerosol growth vessel.

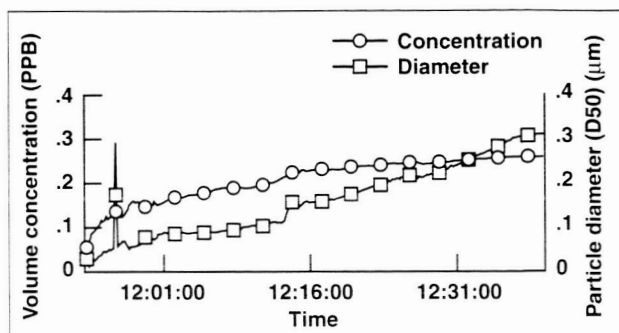


Fig. 2. Dynamic acetylene photolysis test data.

measurements (up to 100 microns). A customized software and electronics package automatically shifts from polarization to diffraction-based measurements as the angular scattering detector attains an acceptable signal-to-noise ratio. Results from static experiments utilizing Freon, flow-through experiments utilizing sodium chloride (NaCl) and carbon particles, and dynamic acetylene photolysis experiments were performed that provided comparative particle-size data with data obtained with a scanning electron microscope. The second figure illustrates particle growth in acetylene that was photolyzed with 1800-angstrom ultraviolet radiation. In this set of measurements, the particle diameter ranges from about 0.03 micron to 0.33 micron, and the concentration increases from 0.06 to 0.27 parts per billion.

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